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THE STATUS OF THE AVIFAUNA OF THE REVILLAGIGEDO ISLANDS, MEXICO

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Despite their relative proximity to Baja California and the Mexican mainland, the Revillagigedo Islands (frequently but erroneously written "Revilla Gigedo," Richards and Brattstrom 1959:328) have been visited only infrequently by scientists. The avifauna of these four islands (in descending size, Socorro, Clarión, San Benedicto and Roca Partida) has been reviewed most recently by Brattstrom and Howell (1956).

In April 1978, a Carnegie Museum of Natural History/Hubbs-Sea World Research Institute expedition visited Socorro and San Benedicto islands, which are located between 370 and 400 km (230-250 miles) south of the tip of Baja California. The trip was prompted by rumors of the development of an airstrip on Socorro. Our purpose was to determine the status of the endemic birdlife, and to obtain anatomical material and sound recordings, which had not been available previously, for taxonomic studies. A second expedition, in April 1981, was directed at clarifying the status of several species in light of our earlier findings.

In this paper we review the results of those expeditions and summarize the findings of several other trips to the islands. Mainly we present data that amplify the findings of Brattstrom and Howell (1956). Specimens collected in 1978 went to the Carnegie Museum of Natural History (CM); a few were exchanged to the Royal Ontario Museum (ROM), and one Townsend's Shearwater (*Puffinus auricularis*) specimen went to Hubbs-Sea World Research Institute (HSWRI). Weights for endemic land birds are listed. No specimens were obtained in 1981.

Descriptions and maps of the Revillagigedos, including place names used in this report, may be found in Richards and Brattstrom (1959; see also Fig. 1).

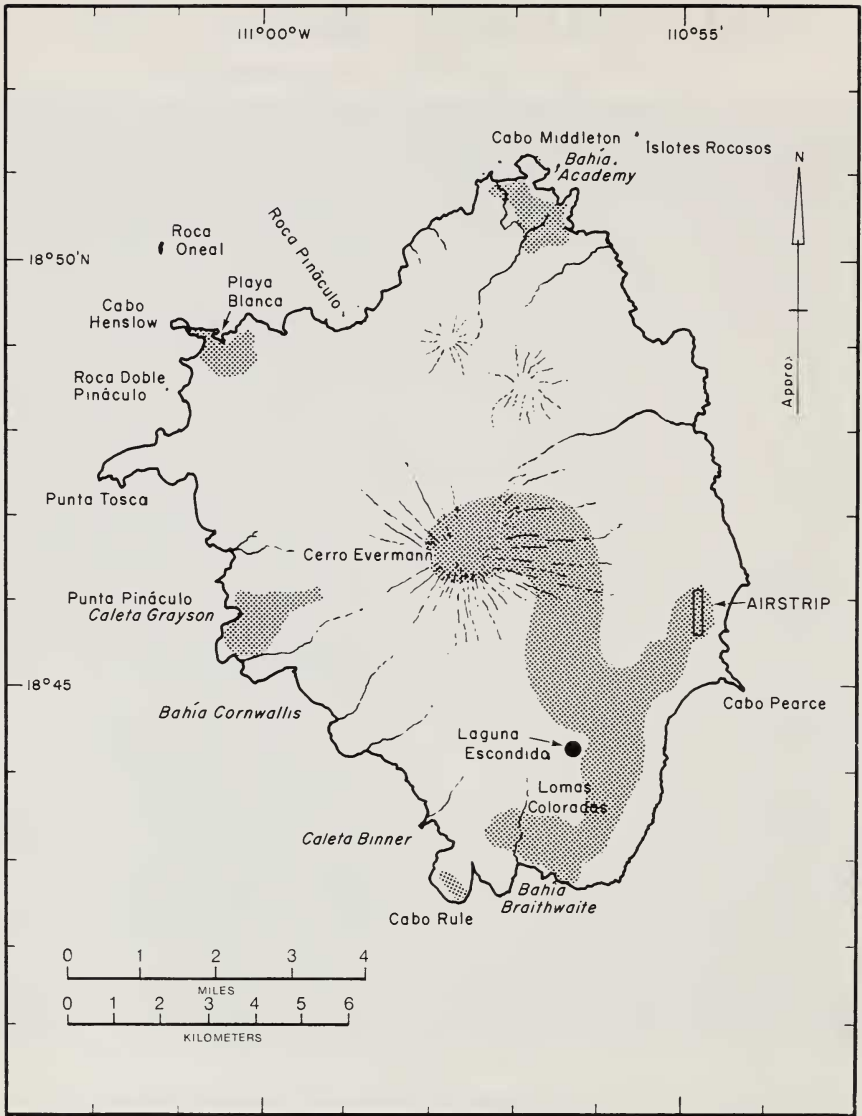


FIG. 1. Socorro Island (after Richards and Brattstrom 1959). Stippled areas were investigated by field parties in either 1978 or 1981.

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We departed Puerto Vallarta, Mexico, on 8 April 1978, arriving at Socorro on 9 April. We spent 10 April in the vicinity of Caleta Grayson (Grayson's Cove); 11 April at Cabo Henslow

(Playa Blanca); 12–13 April near the airstrip and the east side of Cerro Evermann (the central peak of Socorro), and between the airstrip and the military garrison at Bahía Braithwaite; 14 April at Academy Bay; 15 April at Caleta Grayson and at sea 2–8 km off the east side of the island. On the afternoon of 15 April we departed for San Benedicto Island, arriving in the late afternoon. The 16th was spent ashore, and in the early evening we departed for Cabo San Lucas, Baja California, arriving on the morning of 18 April. The scientific party consisted of J. C. Barlow, B. H. Brattstrom, J. R. Jehl, Jr., R. V. Moran, K. C. Parkes and R. L. Pitman.

On 3 April 1981, Brattstrom, Jehl, Moran and Parkes departed Cabo San Lucas, arriving at Socorro early on 4 April. Jehl, Parkes and Moran spent 4–6 April ashore, mainly in the forested areas at 500–1040 m on the east and north sides of Cerro Evermann. Other observations were made in the dry wooded and open areas between Cerro Evermann and Bahía Braithwaite on 6 April. We also visited the small temporary lake described by Brattstrom and Howell (1956) and known to the inhabitants as Laguna Escondida. Brattstrom made additional observations in the vicinity of Bahía Braithwaite and the military garrison (4 April), Bahía Academy (5 April), and Caleta Grayson (6 April). On 7 April, Brattstrom, Moran and Parkes investigated the Cabo Henslow area, while Jehl made observations on seabirds at Roca Oneal and elsewhere on the east and north sides of the island. The evening of 7 April and the morning of 8 April were spent in a brief survey of San Benedicto. We returned to Cabo San Lucas on the 9th.

Other studies.—In April 1955, January 1956, August 1961 and November 1971, Brattstrom made additional notes on the avifauna as part of his intensive and long-term studies of the islands.

In November 1974, Jehl and Pitman, aboard the R/V Hero en route to South America, passed close by Socorro on the morning of 18 November. Mechanical problems forced the ship to return to Bahía Braithwaite, and between 21 and 25 November they made observations of all birds passing near the ship, which was anchored approximately 2 km off the coast; land-based studies were not feasible.

In the following annotated list, species not listed for the Revillagigedos by Brattstrom and Howell (1956) are indicated by an asterisk.*

ANNOTATED LIST OF SPECIES

*Pied-billed Grebe (*Podilymbus podiceps*).—Brattstrom found one dead on the beach at Cabo Henslow, Socorro, on 14 November 1971 (preserved California State Univ., Fullerton).

*Black-footed Albatross (*Diomedea nigripes*).—A specimen in CM was collected by A. W. Anthony at sea 24 km N of San Benedicto on 3 June 1897, but not listed by Anthony (1898) in his paper on the avifauna of the islands, unless this was the bird mentioned as having been “seen a short distance from Clarión.”

*Pink-footed Shearwater (*Puffinus creatopus*).—One 45 km N of San Benedicto, 8 April 1981.

Wedge-tailed Shearwater (*P. pacificus*).—In November 1974, a few were seen daily at Bahía Braithwaite. On 15 April 1978, 30 fed along with 200 Townsend’s Shearwaters 2–8 km W of Socorro. On 15 April 1978 and on 7 April 1981, 50 and 363 shearwaters, respectively, were counted off the

south coast of San Benedicto, as the birds began to stage prior to arrival at the nesting areas. A flock of ca. 150, mixed with other seabirds, was feeding over a school of tuna 30 km N of San Benedicto on 8 April 1981.

In 1978 Pitman estimated 1000 burrows near the top of Herrera Crater and Volcán Bárcena on San Benedicto; none was occupied. In 1981 Jehl saw a few hundred burrows on the rim of Herrera Crater; many had fresh footprints at the entrances but all checked were empty.

Anthony (1898) said that around San Benedicto and Socorro, the only places he saw this species, the sooty plumaged outnumbered the light-bellied by about two to one. He also stated that, in his series of 75 specimens, there was much variation in color of the underparts. This variation is confirmed by 52 Anthony specimens from San Benedicto now in CM. Although at least half would be characterized as "dark," there is such a spectrum that delimiting "dark," "intermediate" and "light" would be arbitrary. King (1974) reviewed the distribution of color phases in several Pacific Ocean colonies and, although giving the proportion of light birds at San Benedicto as 33% or less, based on data from the literature, he correctly inferred that the percentage was probably much less. At present the dark birds comprise virtually the entire population. In 1978 only four of over 300 birds were light-phased, and in 1981 only one of about 600. In 1981 we also saw and photographed a half dozen individuals of intermediate" appearance, with relatively dark backs, dusky bellies and smudgy underwings.

Townsend's Shearwater (*P. auricularis*).—Common 2–8 km off Socorro in 1974, 1978 and 1981. In November 1974, small flocks totalling a few hundred birds staged well off the south coast in early evening. We were unable to reach the nesting areas on Cerro Evermann in 1978, although we heard one bird calling over the island, near the airstrip, on 12 April. The shearwaters were very common over the island on 5–6 April 1981 and hundreds flew over our camps at 500–650 m altitude, beginning about one h after sunset. Evidently the major breeding sites are between 650–850 m. Despite checking many burrows in the soil and suitable crevices in rocky outcrops we found no nests so that we are unable to suggest the stage of the breeding cycle. We found the remains of four shearwaters that had been killed, almost certainly by feral cats (*Felis catus*). There are no other predators on the island except the diurnal Red-tailed Hawk (*Buteo jamaicensis*) (see also, Barn Owl [*Tyto alba*]). Although the number of kills was small, all carcasses were discovered within a few meters of the trail to the top of the island, which leads us to suspect that the carnage is more extensive.

*Galapagos Storm-Petrel (*Oceanodroma tethys*).—In November 1974 this storm-petrel was uncommon but regular in the general vicinity of Socorro.

TABLE 1
BOOBY POPULATIONS AT SAN BENEDICTO ISLAND

Species	No. nesting pairs ^a		No. individuals ^b	
	1978	1981	1978	1981
<i>Sula dactylatra</i>	1500–2000	1000	several 1000's	2000
<i>Sula leucogaster</i>	4	1+	23	20
<i>Sula sula</i>	60	?	877	400

^a Based on counts in the breeding colonies.

^b Estimated from numbers of birds returning to the colony at sunset.

Red-billed Tropicbird (*Phaethon aethereus*).—One or two were seen almost daily within 2–8 km of Socorro in 1974, 1978 and 1981. On 7 April 1981, Jehl saw two to four pairs courting over Roca Oneal, where they doubtless breed. Barlow found a nest on the lava delta on San Benedicto on 16 April 1978; it contained a nearly fledged chick. Pitman reported ten birds (but no evidence of nesting) near the top of that island on the same date.

Blue-footed Booby (*Sula nebouxii*).—Nelson (1978:447) stated: "At one time, though perhaps not now, San Benedicto and perhaps Clarión seem to have been the only islands in the world upon which four species of boobies nested (white [masked], brown, red-footed and blue-footed)." No documentation is offered for this statement with respect to Clarión; for San Benedicto Nelson (1978:517) presented a statement in quotation marks: "hundreds of pairs nesting on the slopes July 1939," but failed to specify the source. There is no obvious source for such a statement among the works listed in Nelson's bibliography. None of the early avifaunal reports mentioned the Blue-footed Booby in the Revillagigedos. We regard the reported breeding of this species on San Benedicto as dubious, at best. That it is an occasional visitor to San Benedicto rests on the evidence of Brattstrom (1963) and Brattstrom and Howell (1956), who reported three on 17 November 1953, and Parkes, who tentatively identified one over the lava delta on 8 April 1981.

Masked Booby (*S. dactylatra*).—In November 1974, April 1978 and April 1981, one to four were seen daily at Socorro. Yet, at San Benedicto, only 48 km away, the species is abundant. In both 1978 and 1981 we counted birds arriving at the island at dusk (Table 1). On the island Pitman estimated 1500–2000 nests in various stages, from single eggs to one with a one-third grown chick. The largest nesting concentrations were on the west side of Herrera Crater. No immatures were in the colony and we saw only one in the entire area. In 1981 Jehl counted a minimum of 937 nests

in Herrera Crater; at a few only paired adults were in attendance; most contained eggs and chicks to 2 weeks old. A few large downy chicks were present, but none in juvenal plumage. Only two immatures were seen near the island.

Red-footed Booby (*S. sula*).—One or two could be seen daily within 2–8 km of Socorro in 1974, 1978 and 1981. At San Benedicto, on 16 April 1978, the colony on the lava delta contained about 40 pairs; other smaller colonies were at Punta Oaxaca and Trinidad Rocks. At least a half-dozen pairs were nesting on the delta on 8 April 1981, but the colony could not be fully surveyed.

All of the birds at Socorro and the vast majority at sea near San Benedicto were in intermediate or dark phase, whereas, in 1978, approximately 80% of the nesting birds were light phased, 20% intermediate or dark. Several mixed pairs were present.

Although Brattstrom and Howell (1956) failed to comment on the point, the relative abundance of the boobies on San Benedicto has changed substantially since 1897. Anthony (1898) found *S. sula* "by far the most abundant species on the island." *S. dactylatra* was "common," and *S. leucogaster* "about as common as [*S. dactylatra*]." Anthony did not mention *S. nebouxii*. The breeding season for *S. sula* in 1897 was later than in 1978 or 1981. Anthony took fresh eggs on 1 May, and found that second sets had been deposited in the same nests on 17 May. "A few young were found on the latter date." In contrast, on 16 April 1978 and 8 April 1981, Parkes found young of all sizes in the Lava Delta colony, from small downy squabs to fully-feathered juveniles still at nests with their parents.

Brown Booby (*S. leucogaster*).—One or two were seen daily at Socorro in 1974, 1978 and 1981. At San Benedicto this was by far the rarest of the boobies; only five were seen returning to roost on the evening of 15 April 1978, and eight on 7 April 1981. In 1978 Pitman found four nests, one with one egg, one with a small chick and two with single chicks nearly ready to fledge. In 1981 Jehl saw one nest, which he was unable to reach.

Great Frigatebird (*Fregata minor*).—This species was never identified at Socorro nor at sea near the islands. It is fairly common at San Benedicto, however. In 1978 Pitman reported about 50, including some newly fledged young, roosting on the northwest side of the island. On the north side of Herrera Crater he found about 50 birds and five nests, two containing an egg each and three at which adults were incubating or brooding; a few fledglings were present. In 1981 we discovered a colony of about 50 pairs on a steep cliff on the northwestern side of the island; the area was not approachable by land and the contents of the nests were undeterminable. An adult and an immature female were collected on 16 April 1978; the adult showed little or no body molt and the largest ova were 2

mm in diameter; the immature was not molting. Brattstrom (pers. comm.) found frigatebirds (almost certainly *F. minor*) nesting on Roca Partida in 1971, but could not determine the species.

*Magnificent Frigatebird (*F. magnificens*).—Although all authors through Brattstrom and Howell (1956) have reported only *F. minor* from the Revillagigedos, all of 5–10 frigatebirds seen at Socorro in November 1974, April 1978 and April 1981 were clearly *magnificens*. Magnificent Frigatebirds were also seen at San Benedicto. In April 1978 both species were present, in seemingly equal numbers, near the lava delta. Two females of *magnificens* were collected; neither had ova greater than 2 mm in diameter, and one was in heavy molt. In 1981 several *magnificens* were present at that locality, but *minor* predominated.

F. magnificens and *F. minor* are known to be sympatric only in the Galápagos. As frigatebirds do not normally wander far from the immediate area of nesting colonies, the presence of an adult male Magnificent Frigatebird with enlarged testes (19 × 13 mm) collected at Bahía Academy, Socorro, on 14 April 1978, suggests that this species may nest in the extensive areas of wooded habitat there.

*Cattle Egret (*Bubulcus ibis*).—While anchored at Socorro on 21–25 November 1974, Pitman and Jehl watched flocks of 11, 19 and 35 arrive at the southern end of the island in the early morning. In 1981 at least six to eight were present at the military base on Socorro, and the base commander informed Jehl that he believed some remained year-round.

Snowy Egret (*Egretta thula*).—Considered “casual” on Clarión by Brattstrom and Howell (1956). Brattstrom reported four egrets, presumed to be Snowy, on Clarión on 9 November 1971, but did not consider the possibility of Cattle Egrets, which were invading Baja California in that period (Power and Rising 1975).

Yellow-crowned Night Heron (*Nyctanassa violacea gravioris*).—This endemic race, resident on Socorro, is evidently very secretive. Only one was actually seen in 1978, a few hundred meters inland at Bahía Academy, and none was seen in 1981. However, we heard calls at night on the east side of the island, saw footprints at Playa Blanca and Bahía Academy, and found numerous middens of crab remains, some on the edge of high cliffs overlooking the sea, all ample proof of the continued presence of the heron.

*Duck (*Anas* sp.).—Brattstrom saw a duck, similar to a female Mallard (*A. platyrhynchos*), in a pond on Clarión on 8 November 1971. Except for a sight record of Blue-winged Teal (*A. discors*) on Clarión (Brattstrom and Howell 1956), this is the only record for an anatid in the Revillagigedos, unless one accepts literally the observations in the fall of 1793 of Captain James Colnett, who “made no attempt to visit the interior of Socorro, but

assumed the existence of a freshwater lake in the hinterland, because of the number of teal in flight" (McLellan 1925).

Red-tailed Hawk (*B. j. socorroensis*).—Found everywhere on Socorro. At least one pair was present at each area we visited including Caleta Grayson, Bahía Academy, the east side and crest of Cerro Evermann, Playa Blanca and Bahía Braithwaite. Brattstrom reported three at Cabo Middleton in 1971. We estimated the population at 15–25 pairs.

There are no native mammals on Socorro. Brattstrom and Howell (1956) conjectured the hawks may often feed on lizards, as "the lizards of Socorro are much wariier than the related species on Clarión, where no hawks are resident." Land crabs are also an important component of their diet (Grayson 1872; Brattstrom, pers. comm.). McLellan (1926) described a pair feeding on a small lamb (carrion?). Villa (1960) described the capture of ground-doves (*Columbina*) by Red-tailed Hawks, and McLellan (1926) found the remains of *Zenaida graysoni* in the crop of a hawk specimen. Villa (1960) stated that in 1958 the military detachment protected all bird-life except the Red-tailed Hawks, as the latter preyed on birds, which they pursued even through the encampment. Those marines authorized to hunt sheep shot hawks when they had the opportunity. We doubt that the practice of shooting hawks continues and the hawk remains abundant.

All published descriptions of this race seem based on the type series of three birds in pale or "normal" plumage in the National Museum of Natural History. Consequently, comparisons (e.g., Friedmann 1950) have been made with the pale phase of *B. j. calurus*. Either the collection of these three specimens was a sampling accident or the color phase structure of the Socorro population has changed. We found *socorroensis* to be highly variable but predominantly melanic (65–75% of 20 birds observed), although none reached the blackish extreme of *calurus* illustrated by Taverner (1927:pl. III.). One rather dark adult female collected at Bahía Academy on 14 April 1978 is similar to a female *calurus* (CM 136425) from the Mackenzie Delta, N.W.T., Canada. We find that *socorroensis* cannot be separated from *calurus* on the basis of color and the validity of *socorroensis* must rest on its more robust legs and feet. The diameter of its tarsi and toes is obviously greater, but this is not revealed by standard linear measurements; comparative measurements should be made on osteological material, which is not available for the island form.

As all of the published measurements of *socorroensis* are derived from the type series, we present those of our adult female, and compare them with those of the single female (in parentheses; from Friedmann 1950) in the USNM: wing chord 385 (415); tail 215+ [very worn] (232); culmen from cere 27.7 (29.5); tarsus 93.5 (90); middle toe without claw 52.7 (50); weight 1260 g [little fat] (not available for other specimen).

Osprey (*Pandion haliaetus*).—Considered “accidental on San Benedicto and Socorro” (Brattstrom and Howell 1956), but probably a regular winter visitor, as it is in the Galápagos far to the southeast. Brattstrom reported two on Socorro in 1971. We saw one over Caleta Grayson on 10 April 1978, one at Cabo Henslow on 11 April, and one at San Benedicto on 16 April.

Peregrine Falcon (*Falco peregrinus*).—Listed by Brattstrom and Howell (1956) as “accidental on Socorro.” Pitman saw one at San Benedicto on 16 April 1978, and Brattstrom reported one on San Benedicto on 8 April 1981.

*Black-bellied Plover (*Pluvialis squatarola*).—Three birds on a denuded plain near the airstrip on Socorro on 13 April 1978. This species may have been the “large Plover” seen by Anthony (1898) on Clarión in 1897, with a Golden Plover (*P. dominica*) alongside for size comparison.

Semipalmated Plover (*Charadrius semipalmatus*).—Listed by Brattstrom and Howell (1956) as “accidental on Socorro.” Additional records include one collected at Bahía Academy, Socorro, (Brattstrom, pers. comm.) on 3 May 1955, and one on Socorro, 11 April 1978.

*Killdeer (*C. vociferus*).—Brattstrom reported two on Clarión on 8 November and one on 9 November 1971. Parkes heard one at the lake on Socorro on 6 April 1981.

Whimbrel (*Numenius phaeopus*).—Considered by Brattstrom and Howell (1956) to be casual on the three main islands, but probably regular in winter. There are additional records for Clarión (1971), Socorro (1955, 1971, 1981), and San Benedicto (1978).

*Long-billed Dowitcher (*Limnodromus scolopaceus*).—The remains of a very large individual of this species (presumably a female) were found at the mouth of a Burrowing Owl (*Athene cunicularia*) burrow on Clarión in November 1971.

Western Sandpiper (*Calidris mauri*).—One was seen at Laguna Escondida, Socorro, on 6 April 1981. There is one record from Clarión in March 1953 (Brattstrom and Howell 1956). Brattstrom also saw a “peep” (*C. mauri* or *C. minutilla*) on Clarión in 1971.

*Northern Phalarope (*Phalaropus lobatus*).—One was seen by Brattstrom at Clarión in 1971. A few small flocks were present between Socorro and San Benedicto in 1981.

*Pomarine Jaeger (*Stercorarius pomarinus*).—Two were noted at Bahía Braithwaite, Socorro, on 18 November 1974.

*Heermann's Gull (*Larus heermanni*).—A partial skeleton, found at Playa Blanca, Socorro, 11 April 1978, was identified by Parkes.

*California Gull (*L. californicus*).—A first-winter bird was collected at Socorro in November 1974 (specimen in San Diego Natural History Museum).

*Glaucous-winged Gull (*L. glaucescens*).—Jehl and Pitman collected a first-year bird at Bahía Braithwaite, Socorro, 21 November 1974 (specimen SDNHM).

*Laughing Gull (*L. atricilla*).—One immature observed at Socorro on 21 November 1974.

*Franklin's Gull (*L. pipixcan*).—Dr. Charles Hogue, Los Angeles County Museum, photographed an adult at Socorro on 7 June 1977 (identification confirmed by Jehl).

*Sabine's Gull (*Xema sabini*).—A partial skeleton from San Benedicto, 16 April 1978, was identified by Robert W. Storer.

Brown Noddy (*Anous stolidus*).—Anthony (1898) described the collecting of the type series of *A. s. ridgwayi* (now in CM) on 12 May 1897, from a large nesting colony (also containing many Sooty Terns [*Sterna fuscata*]) "on a rock a mile off the southwest point of the island [i.e., Socorro]." ("Southwest" was undoubtedly a *lapsus* for "northwest." Kaeding (1905), who accompanied Anthony, described the rock as "lying a few miles to the northward of Socorro Island.") This description fits Roca Oneal, where the species was said by Brattstrom and Howell (1956) to nest. On 7 April 1981, we saw 20 along the east side of Socorro and a few others between Socorro and San Benedicto.

*Mourning Dove (*Zenaida macroura*).—The occurrence of this species on Socorro was totally unexpected. It has invaded the island since 1958 (and perhaps 1971, the date of Brattstrom's most recent trip prior to the 1978 expedition), and by 1978 had established itself as an abundant breeder on the SE side, between the airstrip and Bahía Braithwaite. The party saw 100 or more near the airstrip on 12–13 April 1978, heard several calling in the early evening, saw courtship flights, and found one nest with two eggs, one nest containing two squabs, and several deserted nests. A large flock was seen on 12 April by Parkes and Brattstrom on the weedy hillside between Km 4 and Km 5 on the road from the airstrip to Bahía Braithwaite.

In 1981, the doves remained abundant in the lowlands on the southeast side of Socorro, and over 100 were seen in trees adjoining the small lake. We also recorded them sparingly well into the forested areas to 650 m.

These doves were very wary and difficult to approach. In all respects, including voice (recorded by J. C. Barlow in 1978) they seemed identical to *Z. m. marginella*. Two adults and two squabs taken in 1978 show no trace of introgression with the endemic Socorro Dove, nor do they resemble the distinctively proportioned endemic Clarion subspecies (*Z. m. clarionensis*). In 1981, we made careful observations of over 100 individuals, again failing to detect any obvious signs of hybridization with *socorroensis*. Brattstrom found a single Mourning Dove on San Benedicto on 8 April 1981, the only record for that island.

Socorro Dove (*Z. graysoni*).—This dove was once common on Socorro, and existed there as late as 1958 (Villa 1960). We failed to find it, despite intensive efforts in 1981, and presume that it is extinct in the wild. The history of this species will be discussed separately (Jehl and Parkes, unpubl.).

Common Ground-Dove (*Columbina passerina socorroensis*).—Common on Socorro in dry woodlands and open areas on the S and SE slope, in the garrison, along the road to the airstrip, at Playa Blanca, Cabo Rule, and Caleta Grayson. At the latter locality a flock of 40 were present at a small seep on the hillside on 15 April 1978. The species seemed rare and more local in 1978, perhaps because of the very dry conditions in that year. (Weight: 4 ♂♂—32.5–39 [36.2] g; 2 ♀♀—32, 32.5 g.)

Green Parakeet (*Aratinga holochlora brevipes*).—This species was encountered in small flocks (3–10 birds, once 30) in heavily wooded areas above 500 m around Cerro Evermann. Though not particularly common, their raucous calls make them very conspicuous. (Weight: 3 ♂♂—150, 150, 155 g.)

Common Barn-Owl (*Tyto alba*).—Villa (1960) is the only author to have suggested the presence on Socorro of any owl other than the endemic Elf Owl. He stated that he found in a fig tree at Bahía Braithwaite “huellas inequívocas” of owls of this species, and that members of the naval detachment reported finding a nest with two young a few days earlier. Furthermore, on 18 January, while camped east of Laguna Escondida, he heard what he took to be “el monótono canto de varias de estas lechuzas.” Although this owl is a notorious colonizer of islands, its presence on Socorro must be considered unproven.

Elf Owl (*Micrathene whitneyi graysoni*).—Villa (1960) did not encounter this species during his 1958 visit to Socorro, and mentioned no records subsequent to the specimens collected by Slevin in 1925 (McLellan 1926). However, he believed that it was still “más bien común” on the island, judging from information obtained from military personnel. To our knowledge, the most recent record is a specimen taken 27 March 1932 (Calif. Acad. Sci.). In 1978 Barlow, Pitman and Jehl listened for owls in the dry woodlands near the airstrip. And on two nights in 1981, using a tape recording, Jehl and Parkes tried unsuccessfully to elicit responses, in wooded areas at 500 m and 650 m. However, we were not ashore at night in the habitat in which McLellan described Elf Owls as “less rare than they were formerly supposed to be,” i.e., “dense growth on the lower levels of the island”; Slevin’s specimens were taken “in a tree at the bottom of an arroyo near Braithwaite Bay.” Both adequate nesting cavities and grasshoppers, small crabs (Grayson 1872) and other suitable food for this owl are abundant.

Belted Kingfisher (*Ceryle alcyon*).—Considered accidental on Socorro and Clarión by Brattstrom and Howell (1956) but probably regular in winter. We saw several on Socorro in 1978 and Brattstrom reported three in various localities in 1971.

*Rough-winged Swallow (*Stelgidopteryx ruficollis*).—Two were seen at Bahía Academy, Socorro, 14 April 1978.

Common Raven (*Corvus corax clarionensis*).—Brattstrom and Howell (1956) considered the raven as a "regular visitor" on San Benedicto, but which bred only on Clarión. We saw no ravens on San Benedicto on either of our visits, nor did Brattstrom (1956) in 1953. There is no doubt, however, that the species formerly occurred there. Townsend (1890) called it "abundant," Anthony (1898) characterized it as "rather common" and Hanna (1926) considered it "not very abundant," but saw six. There are no records from Socorro, the most frequently studied island, only 43 km from San Benedicto. Thus, we doubt that ravens at San Benedicto were merely visitors from Clarión, 362 km away. More likely, they were residents which became extirpated prior to, or by, the eruption of Volcán Bárcena in 1952.

Brattstrom estimated the raven population on Clarión at 75–100 birds in 1955 and at 256 in 1971. The 1953 population was estimated by Brattstrom and Howell (1956) at 400–450 individuals.

Socorro Wren (*Thryomanes sissonii*).—This species, second in abundance to the Tropical Parula, occurred at every locality we visited on Socorro up to the crest of Cerro Evermann (1040 m). At Caleta Grayson it was outnumbered about 10:1 by the warbler and was most common in the woods near the shore; it also occurred in the brushy hillsides to the edge of the beach. This wren occurs in low strata and was almost always seen on or near the ground, seldom higher than 2 m in trees. Several families of wrens with recently fledged young were seen on 5–6 April 1981.

As noted by Brattstrom and Howell (1956) the generic relationships of the wrens on Socorro (*T. sissonii*) and on Clarión (*Troglodytes tanneri*) are uncertain. Preliminary data (Barlow, pers. comm.) support the transfer of the Socorro Wren to *Troglodytes*. (Weight: 6 ♂♂—8.5–11.0 (9.2) g; 3 ♀♀—9.3, 9.7, 10.0 g; 5 sex?, 8.5–10.0 (9.2) g.)

Rock Wren (*Salpinctes obsoletus exsul*).—Like other observers since the eruption of Volcán Bárcena in 1952, we failed to find this endemic wren on San Benedicto, and agree with Brattstrom and Howell (1956) that it is extinct.

Northern Mockingbird (*Mimus polyglottos*).—This species is another recent invader of Socorro. Brattstrom reported one at Caleta Grayson on 10 April 1978, and Parkes and Brattstrom saw two, about 300 m apart, in open country near Km 5 on the road to the airstrip on 12 April 1978. By April 1981, the species was abundant on the SE side of the island, up to

400 m elevation, in open and scrubby areas. On 6 April, we saw at least 30 individuals and found a nest with a large chick. The species is now restricted to this area of the island and there does not appear to be suitable habitat for it elsewhere. There is a previous sight record for Clarión (Brattstrom and Howell 1956).

Socorro Mockingbird ("Thrasher") (*Mimodes graysoni*).—This endemic mimid was considered by McLellan (1926) "the most abundant and most widely distributed species on Socorro. They were particularly numerous about the spring at Caleta Grayson, and in the heavily wooded cañons. Eight males (one immature) and two females were collected on May 3." Brattstrom (in Brattstrom and Howell 1956) found *Mimodes* "common at lower elevations" in March 1953, but noted no singing. In November 1953, they "appeared to be rare at lower elevations on the south side of Socorro but common in forested areas at higher elevations and in canyons on the north side of the island. Some aggressive behavior and much singing were noted at this season." Villa (1960) described the species as abundant in the higher wooded areas of the island in January 1958, and emphasized its extreme tameness; two that entered his camp fed on bread crumbs from his hand and one of these even perched on his shoulder and sang. In 1955 and 1971, Brattstrom (in litt.) found *Mimodes* as high as 700 m on the south side of Cerro Evermann.

In 1978, we saw *Mimodes* only at Playa Blanca (4 or 5), Caleta Grayson (1), Academy Bay (1, singing), and near the airstrip, where our party was able to find only two in two days of fieldwork. In 1981 we spent little or no time in areas where we had found this species previously. At Playa Blanca, Parkes, using a tape playback, elicited a distant vocal response, and later lured into the open what may have been the same (or a second) individual, which approached within less than 2 m but sang only weakly in response to the tape. Brattstrom did not see or hear *Mimodes* at Caleta Grayson or Bahía Academy.

Although *M. graysoni* was widespread in the recent past, it seems now to be almost entirely restricted to the vicinity of large fig groves near the coast. Such habitat is now very rare. Our visits to Socorro were not made at the optimum season for hearing songs, judging from the observations of Villa and Brattstrom, but the former conspicuousness and tameness of this species strongly suggest to us that it is indeed absent or exceedingly rare in most of its previous range. We suspect that the prospects for its survival are dubious.

This species is universally called "Socorro Thrasher" in the literature. While it is true that Lawrence (1871), following a manuscript of Baird, named it in the genus *Harporhynchus* (= *Toxostoma*), it bears little resemblance in the field to a thrasher. The birds appeared to us (and to Grayson

[1872], its discoverer) like rather plainly plumaged mockingbirds, somewhat more heavy-set than *M. polyglottos*. They run for long distances, but sometimes hop for short forays. Both on the ground and on branches or shrub tops they cock their tails in typical mockingbird fashion, but not in as sharp an angle. We saw them foraging along the beach at the edge of the vegetation, where they were relatively tame, and also in low shrubs and trees farther inland, near the airstrip, where they were shy. Of the three current Mexican field guides, only the illustration in Peterson and Chalif (1973:pl. 34) approaches accuracy; all three portray the iris as yellow, whereas in our specimens it was actually brownish red. (Weight: 2 ♂♂—71, 73 g; imm. sex?—58 g.)

*Tennessee Warbler (*Vermivora peregrina*).—One was seen at Bahía Braithwaite, Socorro, on 12 April 1978.

Tropical Parula (*Parula pitiayumi graysoni*).—Brattstrom and Howell (1956) stated: "These little warblers were fairly common at lower elevations on Socorro, but they seemed scarcer than the other endemic land birds although equally tame and easy to approach . . . No singing or territorial behavior was noted in either March or November." In April 1978 and 1981 the endemic "Socorro Warbler" was by far the most common land bird on Socorro, occurring from the beaches to within 50 m of the peak of Cerro Evermann. They were most abundant in wooded areas such as the fig groves at Caleta Grayson and the forested uplands at 500–800 m, but were also fairly common on the dry, brush-covered hillsides, where their actions were reminiscent of those of Orange-crowned Warblers (*Vermivora celata*) in the western U.S. In wooded areas they fed nearly everywhere on the branches, from less than 1 m above the ground (occasionally even descending briefly to the ground) to the treetops, even hanging from the tips of leaves like tits (*Parus* spp.). Although generally gleaners, they would make short aerial forays after flying insects.

Although songs were commonly heard in 1981 (less frequently in 1978, at approximately the same time of year), there was little or no evidence of territorial behavior. In several areas of food abundance, gatherings of as many as 30–50 were seen; "squeaking" inevitably attracted groups of six to ten or more. There are several distinctive songs, plus a number of variations on these. The commonest is highly reminiscent of the simple song of the American Redstart (*Setophaga ruticilla*); another is closely similar to that of the Northern Parula (*Parula americana*); a third is a *Dendroica*-like song terminating in emphatic syllables, rather like that of the Chestnut-sided Warbler (*D. pensylvanica*). In 1981, at our camps at 500 and 650 m, we found that the major song period was in the predawn hours, commencing as early as 03:00 and lessening considerably by 06:00. Sporadic singing could be heard throughout the day, and a second peak

occurred in the evening about 15–30 min prior to dark. (Weight: 2 ♂♂—6.0, 6.5 g; 4 ♀♀—6.0–6.5 [6.3] g; 5 sex? [See *Thryomanes sissonii*] 5.8–6.5 [6.1] g.)

*Yellow Warbler (*Dendroica petechia*).—One seen by Parkes at Bahía Braithwaite, Socorro, on 10 April, was clearly an immature male of one of the “Mangrove Warbler” subspecies, either *castaneiceps* of Baja California or *rhizophorae* of the Pacific mainland of Mexico, as evidenced by the extensively gray plumage with touches of yellow. Another, seen by Jehl in the same area on 12 April, belonged to one of the northern races (*annicola* or *rubiginosa*).

Yellow-rumped Warbler (*D. coronata*).—Brattstrom reported a “Myrtle” Warbler on San Benedicto, 8 April 1981. There are no previous records for this eastern form on the islands. However, Villa (1960) reported seeing many “Audubon’s” Warblers on Socorro in January 1958, and collected one.

*Townsend’s Warbler (*D. townsendi*).—A male was collected on Cerro Evermann, 13 April 1978.

*Black-throated Green Warbler (*D. virens*).—Two females collected with the male Townsend’s Warbler on 13 April were loosely associated with a flock of Tropical Parulas (Barlow and Pitman, pers. comm.).

Bay-breasted Warbler (*D. castanea*).—In addition to the San Benedicto specimen collected in November 1953 (Brattstrom and Howell 1956), Brattstrom photographed an immature male of this eastern vagrant on the same island on 15–16 November 1971 (photograph identification confirmed by T. R. Howell and J. R. Jehl, Jr.).

*American Redstart (*Setophaga ruticilla*).—One (female?) was seen on San Benedicto on 15 November 1971.

Rufous-sided Towhee (*Pipilo erythrophthalmus socorroensis*).—Brattstrom and Howell (1956) reported that the endemic towhee was “common on Socorro in the cactus and bush of the lower elevations but [they] were rare among the trees.” We found them at most localities, at least to 650 m, but they were in general uncommon and scattered. Singing was infrequent. They may be more numerous than we recognized, but we doubt that their current abundance approaches that of 1953, or of 1958 when Villa (1960) considered them abundant and conspicuous throughout the island. These birds feed mainly on the ground, but also occasionally forage as much as 3–4 m above the ground near trunks and main branches of large trees. They seldom ventured into open scrub, a common habitat of this species elsewhere, but preferred wooded clumps. They were much shyer than mainland races, which respond, often dramatically, to “squeaking,” which was not true of *socorroensis*. This shyness was in striking contrast to the experience of Anthony (1898), who found towhees to be

“uniformly confiding and often half a dozen would congregate within a few feet of a person, silently inspecting him with an air of trustful curiosity quite foreign to other species of the genus with which I am familiar.” (Weight: 3 ♂♂—29, 30, 30 g; 4 ♀♀—29.5–35 (31.6) g.)

DISCUSSION

The 1978 visit to Socorro occurred during a very dry season (F. Urtaza, pers. comm.); few birds were breeding or singing. In 1981 the vegetation was much lusher and the temporary lake covered about 0.6 hectare, down from a winter maximum of about 1 hectare.

The breeding season for landbirds on Socorro may extend from November through May (Parkes, unpubl.), perhaps being affected by annual variation in rainfall. We suspect that the main breeding period typically occurs late in the year, for during our April visits we saw very few juveniles of any species. Although endemic landbirds may have been less conspicuous during our trips than at other seasons, we have no doubt that the low numbers of Rufous-sided Towhee and Socorro Mockingbird, and especially our failure to find the Socorro Dove, indicate a marked decline in their populations.

Reasons for the changes are not easy to discern. Large numbers of sheep roam over Socorro, having been introduced in 1869 by sailors. The sheep have severely modified the vegetation below about 600 m, particularly on the south and east sides of the island, and many areas are overgrazed and denuded of native plants. The activities of the sheep, alone, cannot have been sufficient to account for the changes, because the decline in some bird populations seems to have occurred since 1958.

A more significant influence may be the presence of a military garrison at Bahía Braithwaite. The garrison was established in 1957 and by 1981 had grown to approximately 125 persons, including military personnel, civilians and a few dependents. The presence of a human settlement invariably means the introduction of domestic animals. In 1971, Brattstrom was informed that feral cats could be found over most of the island; also present were 10 horses, 20 burros, some chickens and a few domestic pigeons. In 1978, the base commander informed us that he was aware of the problems caused by cats and that they were being shot on sight. Even so, we dispatched a litter of kittens near the airstrip and heard adults calling at night. In 1981, we saw no cats, but the shearwater remains on Cerro Evermann give evidence of their continued depredations, even in remote sectors.

It is a matter of conjecture whether the towhee, mockingbird and Socorro Dove were depleted by predators, but it seems likely since the major declines have occurred since the establishment of a permanent human

settlement. Further, the species most seriously affected are ground foragers, and all were described as having been exceptionally tame. Given the dismal record of cats on other islands (e.g., Guadalupe), it would be astounding if their impact on Socorro were negligible. The status of the mockingbird seems especially precarious. The wren and warbler, having more arboreal habits and occurring in abundance, are less likely to be affected. Townsend's Shearwater remains abundant, perhaps granted some respite by virtue of its nesting sites at high elevations, but evidence of predation is undeniable.

We can hardly be optimistic about the future of the endemic avifauna so long as feral animals continue to exist on Socorro, and we urge steps to eliminate or reduce their numbers before further irreversible changes occur. The completion of the airstrip in 1979 does not seem to have imposed any additional stress on the avifauna.

SUMMARY

This paper summarizes the status of birds on islas Socorro and San Benedicto based largely upon visits in April 1978 and April 1981, and presents additional data on Isla Clarión. Isla Socorro is in a state of change, seemingly as a result of increased human activities since 1958 and the consequent introduction of domestic animals. Nine endemic avian taxa have been described for Socorro. In the past two decades, several of these have shown sharp declines which seem largely attributable to predation by domestic cats. *Pipilo erythrophthalmus socorroensis* seems far less common than in the recent past. *Mimodes graysoni*, once described as the most common landbird on Socorro, is extremely rare and local and its condition seems precarious. *Zenaida graysoni* is apparently extinct. *Thryomanes sissonii*, *Aratinga holochlora brevipes*, *Columbina passerina socorroensis* and *Parula pitiayumi graysoni* remain common; indeed the warbler may have increased. We are unable to present any new data for *Nyctanassa violacea gravirostris* or *Micrathene whitneyi graysoni*. Two species have invaded Socorro. *Zenaida macroura* became well established between 1971 and 1978 and *Mimus polyglottos* between 1978 and 1981. Resident landbirds are absent from San Benedicto but seabird numbers have increased since the eruption of Volcán Bárcena in 1952. Notes on 25 species recorded for the first time are included.

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COLORPLATE

The colorplate Frontispiece of Socorro Mockingbird ("Thrasher") (*Mimodes graysoni*) has been made possible by an endowment established by George Miksch Sutton. Photograph by Joseph R. Jehl, Jr.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

The following opinion has been published by ICZN in Bulletin of Zoological Nomenclature, Vol. 38, Pt. 4, 8 Dec. 1981: Opinion No. 1189 (p. 243) "Circinae in Aves and Mollusca: removal of the homonymy." ICZN cannot supply separates of decisions.